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ABSTRACT

The impact that computer assisted learning (CAL) has had on economics teaching in British high schools and the extent of use of CAL materials by British economics primary and secondary teachers is provided through two case studies and a survey. The first case study investigated the use of an economics computer simulation as a teaching aid on the achievement of 2 groups of 11 British high school students. The second case study, involving a group of 12 high school students split into 2 matching groups with regard to ability, compared the use of CAL with the lecture method. Materials used in the case studies were those developed by the Schools Council Computers in the Curriculum Project. Knowledge attainment and students' attitudes were assessed through pre- and posttests and questionnaires. Results show that CAL does not have a superior effect on learning compared with more traditional methods; student motivation is enhanced by the use of the computer; the size and composition of the teaching group is an important determinant of learning; and CAL may be best suited to high ability students. The survey of a sample of 38 members of the Economics Association of Kent (response rate of 50%) and of 21 economics teachers attending an economics education conference in Kent (60% response rate) indicates that CAL has not been integrated into economics teaching to any significant extent. (RM)

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COMPUTER ASSISTED LEARNING

IN A SIXTH FORM

ECONOMICS COURSE

By

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COMPUTER ASSISTED LEARNING IN A SIXTH FORM ECONOMICS COURSE

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Summary

The most significant recent development in computer-assisted learning (CAL) in economics education in the U.K. at the secondary level has been the production of materials for use by economics teachers with their students in schools, resulting from the work of the Schools Council Computers in the Curriculum Project (1973-1977). The purpose of this study is to investigate the value of using the computer as a teaching aid and to examine the nature of the contribution that computer-assisted learning may make to economics education.

The case studies of the Schools Council Computers in the Economics Curriculum materials in use are analysed to provide some evidence on the contribution of this teaching strategy to the economics curriculum. A survey of the extent of use of materials by economics teachers is included to provide some indication of the impact that this innovation has had on economics teaching in schools.

The conclusions that emerge from this study indicate that evidence to show that the use of CAL has a superior effect on learning compared with more traditional methods is slight. Claims that the use of computer models injects greater realism into the study of the subject may be exaggerated, but it seems to be true that the motivation of most students towards the subject is enhanced by the use of the computer. The case studies provide some evidence that the size and composition of the teaching group is an important determinant of learning and that CAL may be best suited to high ability students. It appears that CAL has not been integrated into economics teaching to any significant extent; there may be practical as well as pedagogical reasons for this.

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Author and Title

1. B.D. Cressey. "The Provision of Economics Education in One London Borough" November 1982
2. N.J. Carr. "An Evaluation of the Use of Case Studies in Economics at Advanced Level in Schools." November 1982
3. K.R.J. Wood. "Computer Assisted Learning in a Sixth Form Economics Course" February 1983

I. INTRODUCTION

The most significant recent development in computer-assisted learning (CAL) in economics education in the U.K. at the secondary level has been the production of materials for use by economics teachers with their students in schools, resulting from the work of the Schools Council Computers in the Curriculum Project (1973-1977). These materials enabled teachers to use 'on-line' computer facilities or their own micro-computers in school to run prepared material in a conversational mode in much the same way as they might show a film or play a tape recording. Quite simply, an extra resource, which required no particular skill or expertise specific to its operation, became available with the publication of the Schools Council Computers in the Economics Curriculum materials in 1978.

The aim of the project was described by its Director, R.E.J. Lewis (1979), in a preface to the published materials. 'The aim of the Project and its authors has been to investigate ways in which a student's study of various topics may be enhanced with the aid of a computer program. In common with much recent curriculum development, these materials are designed to encourage student's enquiry by providing new opportunities for asking the question 'What would happen if .....?' There has been no intention of replacing perfectly valid laboratory or field investigations which are often essential in the study of the real world. Neither has there been any desire to replace the teacher in his role as instructor or tutor. In essence the computer program is seen as an additional resource alongside laboratory experiments, field study, films, projects, classroom teaching and discussion. The computer is drawn into the teaching scheme only when it is shown that it can provide a valid and perhaps unique contribution to a sound teaching strategy." (Lewis (1979) p.iii)

The purpose of this study is to investigate what might be considered a valid use of the computer and under what circumstances it may make a unique contribution to economics education. In the following sections, two case studies using the Schools Council Computers in the Economics Curriculum materials in the classroom are analysed in order to provide some evidence on the contribution of computer materials to the economics curriculum, and in order to investigate problems which may arise in using these programs.

If CAL has a unique contribution to make to economics education, it may be in the way in which a computer program can provide a simulation of an economic model so that students may test the impact of a change in one variable, ceteris paribus, on the outcomes of the model. By creating a laboratory-type situation in this way, with the additional advantage of a rapid response to the initial stimulus, CAL may provide a unique opportunity for students to manipulate economic models and try out theories. This point is emphasised by Randall (1979), joint editor of the Schools Council materials. "Many introductory textbooks go to some lengths to explain the nature of economics as a social science. One of its characteristics lies in the inability to perform controlled experiments and econometric solutions are not readily available to students. However, it is possible to simulate experimental conditions by using a computer to generate data from a chosen model. The information provided can be clear and unambiguous in interpretation because the program can be based on the particular model that is being studied at the time. Real world data is usually much too complicated to analyse, but by allowing the student to change one parameter of the model at a time, a controlled 'experiment' can be simulated. Essentially the student can explore a model by manipulating it. Experiments cannot be performed on the economy, but students can explore what are considered to be appropriate models of the economy." (Randall (1979) p.1)

Inherent in the use of this teaching device is the danger that students may be misled into thinking that the ease with which the outcomes of policy decisions taken in isolation and in a controlled computer-experimental environment can be predicted, and the policies adjudged, may be representative of the real world.

Far from unique, but better than anything else because of the speed and sophistication which computers introduce, is the use of computer models as the basis for gaming and problem-solving exercises. The substantial literature on the use of games and simulations in education has been extended by the advent of CAL, which has made games dynamic, more complex, involving a larger number of variables, and more fun for students.

The two units of materials chosen for the case studies presented here are 'The Multiplier' by K.V. Randall, which is a macroeconomic model requiring students to make budget decisions to test knowledge of multipliers, and 'Creation of Credit' by I. Killbery, which aims to unfold the mysteries of the process of credit creation with simulations and a demonstration. These materials are described and analysed in some detail in the following sections.

All of the Schools Council Computers in the Economics Curriculum materials include students' and teachers' notes and, in general. require only that they have a knowledge of economics and the ability to load and run a program. The notes do not constrain the teacher to a particular way of teaching the topic, but are designed to allow maximum flexibility of use. The software comes in the form of cassette or disk for micro-computers of the types 380 Z, Pet and Apple, and punched paper tape and printed listings of the programs are also available.

The results of a survey of CAL users reported in Section 4 indicate that few teachers are likely to experience difficulty in loading and running the software on micro-computers once shown how to do it, although teachers new to the idea do approach the notion of running a program with some trepidation. Any fears are easily allayed. The survey of the use of CAL by economics teachers also gives some indication of the extent of the take-up of the Schools Council materials.

In use, the materials are likely to force the teacher to take the role of adviser rather than instructor. He will know from his notes how the program is put together and what specific teaching objectives may be achieved, and students will ask questions of the teacher when their own knowledge of the subject fails them or when they do not understand the computer's response to an input. The teacher-student relationship alters therefore as the machine provides material for discussion by the teacher and his students. The teacher will not confront the students, but will contribute from within the group as all of the members respond to the computer's output. In this way, the teacher may more easily diagnose weaknesses in the understanding of individual members of the group. A caveat must be entered here because it may, of course, be tempting for the teacher simply to let the students get on with running the program while he takes a back seat. Generally speaking, the materials do not appear to be designed for use in this way and experience suggests that all but the best endowed of students will have questions to be explored with the teacher. Under these circumstances, it goes without saying that the teacher of economics must have a sound grasp of his subject and have familiarised himself sufficiently with the materials to be able to interpret what may initially be fairly unpredictable outcomes produced by the students, in order to exploit new opportunities for students to learn.

The materials which make up the Computers in the Economics Curriculum pack were developed largely by teachers. Internal trials of these materials in schools led to the incorporation of suggestions and improvements by the editors during a process of evolution, but no formal evaluation of the materials in use has been attempted. There are clearly a number of questions which need answers if the use of micro-computers is to be established as a valid teaching aid in the classroom. Apart from the obvious questions of whether using a computer is any better or worse than using any other technique for learning and, if it is better, what are the costs, questions arise as to which aspects of the study of economics lend themselves best to the use of CAL. How will the students react? Is the technique suitable for all abilities? What is the optimum group size to be used with a computer? The case studies of two units of the Computers in the Economics Curriculum materials presented here will, it is hoped, begin to reduce the paucity of evidence about the use of CAL in economics education.

II. A Case Study of the Multiplier Program

The purpose of this case study was to investigate the effect of the use of a computer simulation as a teaching aid on achievement in economics, and to examine the importance of group size and composition for the outcomes of computer-assisted learning in economics.

The materials

The program entitled 'The Multiplier' is based on a simple Keynesian model of a closed economy where consumption is a function of disposable income. Changes in government expenditure, investment and direct taxation have an impact on the level of aggregate demand via the multiplier process. Students using the program are given the opportunity to manipulate government expenditure and direct taxation in an attempt to ensure that demand grows in line with changes in capacity which in turn grows exogenously at 3% per round of the program.

In order to run the program and achieve a high score, students need to have a knowledge of the investment and government expenditure multipliers, $\frac{1}{1-c}$ (where c is the marginal propensity to consume out of disposable income), the direct tax multiplier, $\frac{-c}{1-c}$, and the balanced budget theorem, i.e. know that a change in government expenditure matched by an equal change in taxation will have the effect of changing demand by an amount equal to the tax or government expenditure changes, cet. par. Generally speaking, these are concepts that may be required for success at AL in economics, although some teachers may be a little surprised at the requirement of the direct tax multiplier and the balanced budget theorem.

K. Randall (1979), the author of the program, points out that macro policy simulations of this kind are amongst the earliest and most successful applications of the computer in economics education. Earlier work on macro policy simulations was undertaken by Lumsden and Attiyeh (1970) and it is on one of their models, MPG 1, that this program is based.

The specific students' tasks involved in the use of this program are stated as:

(a) to maintain aggregate demand within about 1% of capacity,

(b) to solve particular problems, e.g. how to deal with an exogenous rise in investment or a politically imposed tax cut.

(c) to answer specific questions on the value of multipliers.

In a complete run of the program students make 12 decisions. The suggested time allowance for this is 25 minutes.

The students' notes provide data on the first five years of operation of the hypothetical economy of the model. This is enough information for an able student to spot the value of the government expenditure multiplier in advance by observing that, with taxation and investment constant, a change of 3 units in government expenditure leads to a change in aggregate demand of 30 units, i.e. $\frac{\Delta Y}{\Delta G} = 10$. Similarly, the marginal propensity to consume out of disposable income may be calculated by observing the change in consumption resulting from a change in disposable income. The MPC is, of course, 0.9.

Table 2.1 The last five years' economic performance

Year	Capacity	Agg.Demand	Govt.Exp.	Taxes	Disp.Inc.	Cons.Exp.	Inv.Exp.
1	542	522	30	42	480	457	35
2	558	552	33	42	510	484	35
3	575	540	30	40	500	475	35
4	592	600	45	50	550	520	35
5	610	600	45	50	550	520	35

(extract from 'The Multiplier' by K. Randall).

It is worth pointing out that this kind of derived data spotting does not come naturally to some, or even most, students of economics.

The author suggests that it would be possible to use the program to introduce students to the concept of the multiplier but gives no indication of how the material might be used in this context. Randall avoids the complications involved in using the multiplier program for initial contact by concentrating the design of the program on 'testing and reinforcement' of the concept. This is the way in which it was used in this case study.

Operation of the program simply requires students to type in a value for government expenditure and for taxation (the computer is sensitive to incorrect signs). With a knowledge of the MPC and the formulae for calculating the various types of multiplier, students can make fairly quick and accurate mental calculations about the size of injection or withdrawal that may be appropriate. For example, in year 6, (the starting point for the student,) with capacity expected to rise to 628, a short-fall in aggregate demand of 28 units may be overcome by an increase in government spending of 2.8 units or a tax reduction of approximately 3 units, or a rather more complicated combination of both which is an option students may tend to avoid, preferring the simple predictability of a one variable change.

The students

The students chosen for this study were in the fourth term of a two-year AL economics course at a co-educational, selective, technical high school in Kent. The first year of the students' course covered microeconomics, with the second year given over to macroeconomics for two terms. At the time of using the program, all the students had attended classes in introductory Keynesian economics, including a study of the concept of the multiplier. The scores on the pre-test in Table 2.1 give some indication of the level of attainment gained from study prior to the computer exercise.

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In terms of the type of school attended, comparison with data generated by the Economics Education Project (Lumsden et al, 1980) from a sample of AL students in 1970 and 1973 shows that the students were not typical. From Table 2.2 it can be seen that fewer students of AL economics are studying in selective maintained schools, with growth in numbers in independent and comprehensive schools, and sixth form colleges.

Table 2.2 Economics students by institution, 1970 and 1973

Institution	Percentage	
	1970	1973
Independent	11.7	15.5
Grant-aided	15.2	6.3
Grammar	50.4	35.7
Comprehensive	10.8	28.3
FE College	11.9	11.0
Sixth Form College		2.7
Other		0.5
Number	5510	5061

(Source: Economics Education in the U.K., 1980)

Lumsden (1980) tentatively suggests from the findings of the Economics Education Project that "..... substantial numbers of (AL) pupils receive teaching which involves problem-solving, programmed texts, audio visual aids and gaming. The predominant teaching methods are however, lecturing and tutoring, which implies that traditional methods of teaching are still the norm." In this respect, the students in the study are not unusual, in that they have been exposed to a method of teaching based on lecturing and tutorials, combined with problem-solving and simulation and gaming exercises with a view to achieving economic understanding without any concession to rote learning, etc.

Lumsden also found that 78% of students in 1973 were taught in classes of up to 20 students, with 54% in classes of size 11 - 20 students. The students involved in this study were taught in a group with an average size of twelve students from the beginning of their AL economics course.

There is some evidence from the Economics Education Project to support the view that mathematics training may help learning in economics. This may have still greater significance when instruction in economics involves the use of the computer. Of the students involved in this case study, 7 were also studying mathematics in some form at AL.

With one exception, the students in the group had experienced some previous use of CAL in early parts of the AL economics course and so would not be expected to be over-awed in any sense by the presence of the machine during this case study.

Organisation of the computer exercise

To take part in the computer exercise, the group of 11 students were split into two groups. The students were allocated randomly to the two groups. All of the students were given a test of understanding of Keynesian economics approximately 24 hours before the start of the exercise. Each group, supervised by their usual teacher, was given about 25 minutes to work through the program whilst

seated around the school's computer. Five or six is probably the largest that a group should be if the practical problem of having all the students see the computer output on a single T.V. screen is to be overcome. In each case the task of pressing the buttons was informally delegated to one of the students. It is important to emphasise here that the skills involved are no greater than those required to punch a typewriter key board. It must be remembered that each response has to be followed by pressing the return key, but no other computer specific skills are required. Even students who are completely new to CAL should experience no problems with computer contact.

Twenty five minutes proved to be adequate time with each group for completion of the exercise. It is, of course, open to doubt whether this was an appropriate amount of time for each individual student and this is discussed later in the section.

All of the students had received a copy of the students' notes 24 hours prior to the use of the computer program, and had been asked to consider the questions listed there:

(1) What causes capacity to change?

(2) Can you predict capacity in year 6?

(3) What determines consumers' expenditure?

(4) What is the government expenditure multiplier?

In each case, the student group was asked to verbalise any difficulties experienced in answering these questions prior to making the first input in the program.

The groups reached their own agreement on input after discussion amongst themselves and, except where discussion seemed to be moving off course, or stuck due to lack of information (when the teacher intervened), the students paced themselves, bearing in mind the time limit imposed at the start of the computer period.

Computer facilities at the school are far from ideal. The computer is in a screened area in the entrance hall to allow maximum access to students following a variety of computer-based courses during breaks, lunchtimes, free periods and after school. As a result some distractions may influence students using the machine for CAL, and, of course, a change of surroundings may take some getting used to before students can happily re-apply themselves to their studies. As far as possible, steps were taken to reduce these aggravations. The problem of access to computer facilities is an important one and is discussed in Section 4.

All of the students were re-tested one day after the computer exercise, using the same test of understanding of Keynesian economics that had been used for the pre-test.

The test

There does not exist a single published test of economics understanding with enough specific items on Keynesian economics and the concept of the multiplier to have been of use in this case study. The test used in this study was a 22 item multiple-choice test which used questions taken from the University of London AL Economics Paper One objective tests for June 1980, January 1981 and June 1981.

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The items were chosen for their applicability to the content of the program. They involve knowledge and understanding of the real side of the Keynesian model covering conditions for equilibrium, the Keynesian-cross diagram, injections and withdrawals, marginal propensities, multipliers, inflationary and deflationary gaps, and fiscal policy.

Thirty-five minutes were allowed for the test which is the same amount of time that the students would have had to answer 22 items in the examination.

It may be argued that what the test score shows is the extent of the students' ability to answer AL questions. This case study using the test described is, therefore, an evaluation of the extent to which use of the materials led to a change in the performance at AL economics of the students involved. There are, of course, many ways of evaluating the effect on students' performance of a set of curriculum materials. This multiple choice test was chosen (a) for its ease and speed of application, and (b) because, in the absence of an alternative, AL examination multiple-choice test items were thought to be more valid and reliable for this purpose than any other available, due to the scrutiny to which AL examination items are subjected before use. Any effects of the use of the computer program on variables other than performance at AL multiple choice examination questions and students' attitudes were not measured in this case study. It seems reasonable to argue, however, that the likelihood of teachers incorporating these materials into the economics curriculum will depend very much on the influence that this has on AL performance, which is a major objective at this level.

Some attempt was made to discover the effect on student motivation through the use of a short, open-ended questionnaire, and the students' comments are presented in another part of this section.

Analysis of results

For the 11 students involved in the study, the average score on the pre-test was 67.8% and the average score on the post-test was 75.2%, showing an average gain of 7.4% (Table 2.3). This is significant at the 95% level of confidence, and may indicate that the use of the materials had a positive effect on the students' ability to answer AL questions on the subject. But it must be stressed that other factors such as the effect of taking the pre-test on students' learning may also have had an influence on the post-test score.

Table 2.3 Pre- and Post-Test Scores of the Test of understanding of Keynesian Economics

Test Scores	
Pre-test score (%)	All students Post-test score (%)
68.2	59.1
86.4	100.0
68.2	77.3
72.7	77.3
50.0	50.0
63.6	72.7
45.5	59.1
86.4	90.9
68.2	81.8
86.4	86.4
50.0	72.7
$\bar{x}$ 67.8	$\bar{x}$ 75.2
average gain 7.4%	
t statistic 2.8	

TABLE 2.4

ANALYSIS OF SCORES BY GROUP. GROUP A

Test scores	Group A
Pre-test score (%)	Post-test score (%)
86.4	100.0
68.2	77.3
72.7	77.3
68.2	81.8
50.0	72.7
$\bar{x}$ 69.1	$\bar{x}$ 8.18
average gain	12.7%
t statistic	4.4

TABLE 2.5

ANALYSIS OF SCORES BY GROUP. GROUP B

Test scores	Group B
Pre-test score (%)	Post-test score (%)
68.2	59.1
50.0	50.0
63.6	72.7
45.5	59.1
86.4	90.9
86.4	86.4
$\bar{x}$ 66.7	$\bar{x}$ 69.7
average gain	3.0%
t statistic	0.86

The students were randomly assigned to the two groups, one containing six and the other five students. Looked at separately, the two groups show marked differences in gain (Tables 2.4 and 2.5). Group A obtained an average pre-test score of 69.1% and an average post-test score of 81.8%, showing a gain in average score of 12.7%, while group B obtained an average pre-test score of 66.7% and an average post-test score of 69.7%, showing a gain of only 3% on average. Application of the Mann-Whitney U Test indicated no statistically significant difference between the average ranks of the groups. Students from one group did not rank higher than students from the other group to an extent which could be considered unlikely to occur by chance. However, the differences in the performances of individual members of the groups are worthy of closer investigation.

In group A, all students made substantial gains over the pre-test scores, suggesting a beneficial effect from the exercise, although, of course, other factors may have been responsible for this. But in group B, one student actually suffered a reduction in score between tests and two students showed no improvement over the pre-test score. Group B did contain one more student, but it is unlikely that this increase in group size could be responsible for the differences. Rather, the cause may be found in an examination of the nature of group work in front of a computer terminal. Observation of this type of group work suggests that it is easy for an individual or small number of individuals to dominate proceedings, leaving out those on the periphery of the discussion, who either become confused because the exercise is moving too fast or become alienated and so take no part in the exercise. Group B clearly contained one exceptional individual who, having obtained a high score of 86.4% on the pre-test, went on to increase his score to 90.9%, and it may be that this individual set a pace for the group which was too fast for the others. This is potentially such a serious problem with this type of group work that it needs further investigation. The obvious way of overcoming the problem, which would be to have individual use of the program, is so expensive in terms of resources needed for multiple access, as to preclude its use in all but the most favourable of circumstances. The students' comments on the exercise throw some light on the problem of pacing the group and ensuring maximum involvement.

Students' attitudes

The students involved in the case study were asked for written answers to the following questions on completion of the exercise.

(1) Did the size of the group affect in any way your involvement with the computer exercise?

(2) Would you have preferred to spend more or less time on

(a) preparation for the exercise,
(b) the actual exercise,
(c) the discussion after the exercise?

(3) Do you feel that your performance in economics has been improved in any way as a result of the use of the computer?

(4) How does use of the computer to teach economics compare with the more conventional approach in your view?

Group size was seen to be important by the students in determining the level of participation in the exercise. The students' comments which follow convey the gist of what was said. Female students had more to say about the constraints on

participation imposed by group size than their male counterparts, but generally, the feeling was that the smaller the group, the better. This apparent concentration of opinion may be due to the fact that the female students were simply more vocal in expressing a view on this aspect of the work, or it may be a function of the majority male composition of the working groups and that females actually did find it difficult to make a contribution.

Group B student: 'I feel that the size of the group could have been smaller - perhaps four instead of six people. This is because it would involve more discussion of each point rather than it being left up to one or two members, which I felt happened to a certain extent.'

Group B student: 'The size of the group was O.K. but somehow it seemed very easy to just opt out of doing anything and just leave it to the brainy ones who knew what was going on. The group was small enough for everyone to have a say but, of course, whoever felt most confident said what happened and the others just agreed.'

The group B students expressing these views either achieved no gain in score as a result of the computer exercise or, in the case of the first, experienced a reduction in test score after the computer exercise. This is to be contrasted with the student who responded to the question as follows:

Group A student: 'My involvement in the exercise was not affected by the size of the group because I felt that I was involved in solving the problems, although, ideally, groups of three would have been more beneficial to get everybody involved.'

Another illuminating insight comes from a group A student who commented on the question of the appropriateness of the group sizes:

Group A student: 'Smaller group because the people who understood it went by their pace, which meant I understood what was going on but didn't have enough time to think of what the answers would be before they had done it.'

With slight reservations, the highest scoring students on the pre- and post-tests both commented favourably on group size:

Group A student: '..... the group was fairly small, and therefore it was easy to take part. Ideally, though, the exercise would be done individually.'

Group B student: 'The number in the group used (6) was about right for the involvement aspect of the exercise.'

Both of these students were dominant in the groups; in each case typing the group's responses into the computer. In both cases these students would be expected by others to show a lead in class because they appear to have a sounder grasp of the subject than most.

These comments in conjunction with the results of the tests raise the question of what is the optimum group size. If it is not significantly greater than one, this would have implications for the use of this mode of instruction, given the time constraints of the examination-orientated curriculum. Mixed ability teaching predominates in AL courses in the secondary school and colleges, so it is hard to imagine that an alternative strategy, with groups of individuals matched on

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ability, could be used in CAL. It is questionable whether this arrangement would be of maximum benefit to the students, since every group, irrespective of the method of instruction, needs its leader(s) who can demonstrate flair and interest in the subject above the average, to motivate and set an example to other students, not to mention the teachers.

The responses to question 2 on timing brought up the perennial problem of preparation. While most students agreed that the exercise could be completed in the time allowed (despite reservations about participation levels), and that debriefing was hardly necessary, most felt that their performance on the program would have been enhanced and, perhaps, more satisfying if preparation had been greater. This raises a number of points. The program was designed by its author for testing and reinforcement, so it is unlikely that performance would be 100% on the first run. Tests tend to show the weaknesses in preparation of all but the most conscientious of students. The ablest student, as measured by test scores, commented:

Group A student: 'I do not think more preparation was necessary, as we were under no time pressure during the exercise, we really went at our own pace. Discussion was not really necessary - the exercise itself was fairly self-explanatory.'

Reinforcement may have been best achieved by having individuals re-run the program, but again this raises problems of the time constraint. In ideal circumstances, students may be able to return to the computer as an extracurricular activity, but left to themselves in this way, students may lack the motivation and determination to do so.

Very well prepared students might have been able to do without the 'test and reinforcement' exercise altogether and to use the time in some more fruitful way which involved less expense. This view is encapsulated in the comment of the student who wrote:

Group A student: 'To spend more time preparing would devalue the aim of using the computer. Having revised, the computer would not have been so much use.'

Views on the effect of using the computer exercise on performance in economics were mixed. Various positive effects were claimed. Amongst them was clarification of theoretical aspects of the subject, especially of the balanced budget theorem, and thus improved performance on some of the test items; a greater awareness of the relevance of the theory for the 'real world'; improved confidence in handling multipliers; and, it was suggested by one student, greater retention.

Group B student: 'The computer exercise gave us a chance to put the theory we had learnt in class into practice, and whereas if you were doing it on paper on your own you could experiment, on the computer you could only make your decision once for each year. You had to know what you were actually doing to get anywhere, so it probably did improve my performance.'

The point that is being made in this quotation suggests that there is a uniqueness in the interrelated mode of computer instruction which is absent from other methods of instruction. It may be this dynamic, conversational aspect of CAL which stimulates those students who are able to respond to it.

The greatest number of improved performances (i.e. student gave an incorrect answer in the pre-test but a correct answer in the post-test) did occur in questions 16, 19 and 20 of the test (Table 2.6) which were about the manipulation of aggregate demand as part of economic policy. This may lend some support to the views expressed by students that using the program led to increased awareness of the real world application of the theory. It may give some cause for concern, however, that in three cases, performance on questions 9 and 21 worsened (i.e. student gave a correct answer in the pre-test but an incorrect answer in the post-test).

There was a mixed response to the question which asked students to compare use of the computer to teach economics with the more conventional approach. Students felt that, while the use of the computer model enabled them to put theory into practice, they preferred, on the whole, a conventional approach to the teaching of the theory. Use of the computer was compared with completing a set of written exercises but perhaps could be less 'mundane'. Students like to be able to stop the teacher and go back. Possibly they feel more secure in the knowledge that the teacher cares whether attention is being paid to the lesson or not. There were references to the 'mathematical side' of the subject and the value of computer exercises in practising this aspect of economics. Generally, however, the view prevailed that computer exercises were an interesting and useful tool in the teacher's kit, but not to be applied without careful teaching first. Of course, the students had experienced limited exposure to the use of CAL in economics and these comments must be seen in this light. Too much enthusiasm for CAL on the part of the teacher may be tempered by the comment of one student who wrote:

Group B student: 'I much prefer the conventional methods. The computer is ultra-boring. It's nice watching the T.V., you can just look at the screen with a semi-interested/intelligent look on your face and yet not be actually watching at all. This is easy to do in class, especially ones with windows, but at least ..... the teacher has the ability to be a bit animated every so often and perhaps recall your attention in that way.'

Comments on the use of the materials

The results of this case study show that for the particular students involved, a significant improvement in the average score on a test using AL multiple choice examination questions was achieved after using the program 'The Multiplier.' That a similar or greater improvement may have been achieved by using some other technique for 'testing and reinforcement' is still a possibility, since no attempt was made to establish a control group in this case study to evaluate the use of the computer program against some other technique However, it is not without value to observe that the use of the materials may have led to an improved performance on average. Of course, students' performance may have been affected by the activity itself; they may have learned from the pre-test and they may have felt encouraged to revise between tests, so it is not possible to be conclusive about the effects of the exercise. Had the average post-test score not shown any significant improvement, there may have been some grounds for investigating why the program had failed to have an impact on the students' performance. The evidence of this case study is that 'The Multiplier' program is a useful adjunct to the techniques available for teaching AL economics, because use of the exercise may have diagnosed some weaknesses in a course based on more conventional methods.

Table 2.6

ANALYSIS OF PERFORMANCE ON TEST ITEMS

Question Number	Performance better in Post-test(1)	Performance worse in Post-test(2)	Net improvement in performance(3)
1	0	0	0
2	2	0	2
3	2	1	1
4	1	1	0
5	3	0	3
6	1	1	0
7	1	2	-1
8	1	1	0
9	1	3	-2
10	1	1	0
11	0	0	0
12	0	1	-1
13	2	1	1
14	2	1	1
15	2	0	2
16	4	1	3
17	1	0	1
18	2	2	0
19	7	1	6
20	4	1	3
21	1	3	-2
22	1	0	1
(TOTAL)	39	21	18

NOTES

1. Better performance indicated by incorrect pre-test answer and correct post-test answer.
2. Worse performance indicated by correct pre-test answer and incorrect post-test answer.
3. Net improvement = no. of better performances - no. of worse performances.

Another positive aspect of the use of the program is its effect on students' attitudes towards the subject, by introducing what may be perceived as a degree of realism and relevance and also by relieving the tedium of any other method which is used without break for any length of time.

It may be a disadvantage that the use of the computer program with groups of students favours the ablest who dominate discussion through superior knowledge of the material and quick-wittedness in applying it. It may also favour those with a mathematical background.

A cost benefit analysis of the use of the program is difficult but important to consider. The benefits of using the program with the students must be set against the cost in terms of time, disruption of the teaching programme and capital input to CAL. In this case study, the school's own computer was used with the published materials available on floppy disk. Due to a refinement in in the system, the published program had to be debugged of syntax errors prior to use. It seems that the original 'Multiplier' program, along with others of the Schools Council materials for computers, contains some 'non-standard' computer grammar! Obtaining access to a computer which is used in a series of computing courses as well as for CAL can mean some adjustment of the economics curriculum to fit in with the computer's time-table. This can have disruptive effects on sequencing in economics courses, and in serious cases, reduce the value of the computer exercise if preparation is not complete. In order to accomplish this case study, considerable reorganisation of the departmental teaching programme was necessary for one week. These problems would not arise if the economics department had its own computer, but this would increase what is an insignificant unit capital cost to an impossibly high one, and make use of the computer merely a dream rather than a somewhat imperfect reality.

In conclusion, the use of the computer program may have served to increase students' performance in the subject and give a boost to motivation. Other methods of testing and reinforcement, such as data response exercises and case study work, may be more readily to hand and, of course, have their strengths as techniques of instruction, but they may not be as stimulating for some students as CAL techniques such as that investigated here, and may not be as effective.

III. A Case Study of the Creation of Credit Program

The purpose of this case study was to compare the use of CAL with the lecture method, in terms of the gain in test scores of AL economics students achieved through a study of the process of credit creation in a fractional reserve banking system.

The materials

The unit of the Schools Council Computers in the Economics Curriculum materials entitled 'Creation of Credit' by I. Killbery (1979) uses the computer to present dynamic models of the process by which banks may create credit. The models are based on the approach to the subject found in texts such as Samuelson (1970). In the author's own words: "A single balance sheet is presented to the student, who has to study it in order to take a decision. The next balance sheet reflects the student's action, and thus provides further motivation. The constraints that affect the student's decision - both 'sticks' and 'carrots' built into the computer model - echo those that shape the banker's business environment, in simplified form. Thus the computer enables students to explore the limitations on banker's ability to create credit by presenting in a simple form quick and accurate calculations of the consequences of 'banking' decisions they have taken. The stress of getting the arithmetic right is removed; time and attention are focussed on interpreting the results. (Killbery (1979) p.112-113)

There are three parts to the program in the unit of materials, and extensive students' notes. The first program is a simulation of a single bank system lending cash. The second is a demonstration of the credit multiplier, where the student may select the percentage cash ratio and the percentage of receipts redeposited in the bank. The third is a simulation of a multi-bank system, each bank giving overdrafts and using cheques with a clearing house system. The students' notes assume some knowledge of introductory ecoromics, e.g. the notion of profit maximisation. The three parts of the program are integrated with the students' notes to provide a coherent teaching package on credit creation, which may be used in the introductory stages of a study of the banking system.

The author suggests that part 1 of the program may be used with small groups of 2 or 3 students or with a whole class using some method of displaying the computer output to the students. Part 2 may be regarded as optional. Again, duplicated runs of the program may be displayed as an alternative. Part 3 may be used by a small group or as a whole class. This particular unit of work was chosen for this case study because, with the students' notes providing the structure of the classwork, it allows for substitution of more conventional methods for the computer and so makes a comparison of alternative methods possible.

Organisation of the case study

This case study attempts to measure the effect on students' performance of using the three parts of the program at the computer compared with using a printout of the material generated by the computer during a previous run of the

program. The question raised is whether or not students benefit from 'hands on' experience of using the program compared with their counterparts who do not, but nevertheless study the same textual material. That is to say, is it worthwhile putting the students in front of the computer to use these materials? It is an important question when due consideration is given to the time and organisational input required to use a computer with small groups of students. The students in the control group in this study were using materials produced by a computer but not through their own interaction with it. This is rather like using a text partially written with the help of a computer which may still be regarded as an aspect of CAL.

For the study, the students were split into two matched groups on the basis of scores on a pre-test of understanding of the process of credit creation. All of the students were presented with a copy of the students' notes. Instruction of the 12 students was based closely on the structure presented in these notes. Only at the points in the development of the material where a part of the program was an option were the students divided, and one group despatched to the computer to run the program, under the supervision of a member of the regular teaching staff of the economics department. The remaining group was taught using a printout of the program presented on an O.H.P. The teaching technique used was simply to run through the program, examining the effects of the inputs in discussion with the students (appendix 3 contains an example of the material used with the control group instead of running part 1 of the program).

Six students at the computer is twice the number recommended by the author of the materials, but it was necessary to use this group size in order to complete the exercise within a reasonable time allocation. Experience suggests that, except where students use the computer in their own time, a group of much less than six students would make CAL almost prohibitively expensive in terms of teaching time foregone, as all students would need to complete the exercise before any class teaching could continue. The opportunity cost of using very small groups would be high, although very small groups may be beneficial for learning. This problem of group size was discussed in the previous section.

The study was carried out over a period of ten days beginning and ending with the test of understanding of the process of credit creation. Approximately 3½ hours of instruction was devoted to the materials.

The students

At the time of the case study the students involved had all completed one term of a two-year AL economics course at a coeducational, selective, technical high school in Kent. The first term of the course covered the elementary theory of supply and demand, including the theory of the firm. So all were familiar with the concept of profit-maximisation. Five of the students had studied economics at OL prior to the course.

The extent to which students on this course are typical of all AL economics students, and the nature of the methods of instruction used, have already been discussed. All of the students had experienced work with the computer during their first term of AL economics, using other units of the Schools Council Computers in the Economics Curriculum materials. CAL could not be regarded as new to the students at the time of this case study. However, the topic 'credit creation' was undoubtedly new to those seven students who had not previously studied economics at OL. In the case of these students, the materials were being used for initial contact with the topic. The students' notes were well-structured and sufficiently comprehensive for this purpose.

The test

The construction of a test of understanding of the process of credit creation posed a problem because (a) no single published test contains sufficient items on the topic; (b) understanding of the process of credit creation is not extensively tested in public examinations, and so this source of valid and reliable test items was not available, and (c) recourse to the many published tests in economics in order to sift out appropriate questions became essential. In the end a 14-item multiple-choice objective test was assembled using questions from a number of source books (appendix 2). All of these books would be recognised as standard texts for an AL economics course and so it may be argued include questions appropriate for a test of understanding of the process of credit creation for AL economics students. To this extent the choice of items may be valid.

The areas covered by the test items included a simple definition of money, the notion of assets and liabilities, the process of credit creation and the reserve assets ratio.

21 minutes were allowed for completion of the test; this proved to be adequate for all students to attempt all of the items.

Bias towards one of the groups can make a test unreliable in this type of study. However, since the instructional materials used by both groups were largely the same (only the mode of instruction differed at certain points), it is unlikely that bias intervened here.

Some attempt was made to gauge the effect of using the materials on the attitudes of the students and is reported below.

It is likely that a sound understanding of the process of credit creation pays dividends in later aspects of a course when, for example, the techniques of monetary control are examined. It was not possible to measure the extent to which this spill-over effect took place in any differential way as a result of using the computer program since the exercise on which this study is based was treated as a self-contained, one-off educational experience to be returned to at some later date in the AL course.

Analysis of results

The post-test scores revealed no significant difference in average gain in performance over the pre-test scores as a result of using the computer (Table 3.1). There was a considerable gain in average score for both groups; the control group gained an average 31 per cent, while the computer group gained 34 per cent, but no statistical significance may be attached to this difference in gain.

This large gain in average scores was to be expected since both groups contained students new to the subject - the low scores in the pre-test reflect the unfamiliarity of the subject matter.

As there appeared to be no major advantage of using the computer in terms of improvement in test score, it may be argued that, as far as this group of students was concerned, the program 'credit creation' provides a useful set of notes, but does not justify the use of CAL. Of course, this result is not, in any sense,

capable of generalisation and may be influenced by the conditions under which the computer program was used. It may be the case that with the use of the program and the use of the materials generated thereby for instructional purposes, the gain in test score would have been greater for all of the students.

Students' attitudes

An attempt was made to obtain some comments on the experience of CAL from the students involved with the computer program using a simple questionnaire which posed the questions:

(1) Did the size of the group affect in any way your involvement with the computer exercise?

(2) Would you have preferred to spend more or less time on (a) preparation for the exercise, (b) the actual exercise, (c) the discussion after the exercise?

(3) Do you feel that your performance in economics has been improved in any way as a result of the use of the computer?

(4) How does use of the computer to teach economics compare with the more conventional approach in your view?

On this question of group size most argued that six was a reasonable number, but the problem of pacing the work with the program to suit all the students arose, as it had done in the previous study. Again some students felt left out because of the domination of the group by the better informed and quick-witted individuals in the group.

Responses to the question of time to be spent on the exercise showed that students felt a little at sea not knowing how the computer was producing the numbers that it was printing out. This problem was anticipated, since the students' notes provide no information on the assumptions of the models. This is to be found in the teachers' notes. For example, in the case of the first part of the program, the teachers' notes provide the following information:

> The computer model generates 'inpayments' and 'withdrawals' to represent each month's business for the banker as follows.
>
> Withdrawals are any figure at random between all and half of the deposits. Inpayments are any figure, again at random but different, between all and half the sum of deposits plus the month's net additional loans. Thus the inpayments reflect the likelihood that some money the banker lends will, when spent, be deposited back with him by somebody else. Less obviously, when the banker is recalling loans, money used to repay the banker will reduce new deposits because that money cannot be spent on buying goods from sellers, some of whom would have deposited their receipts with the banker. The messages giving information about the business prospects at the beginning of the month are selected from a list of fifteen according to the difference between inpayments and withdrawals.
>
> The end of month balance sheet is then calculated as follows:
>
> (a) loans consist of those outstanding at the end of the previous month less 1/12th assumed to be due for repayment PLUS any additional loans (as decided by the student).
>
> (b) Cash consists of last month's cash LESS money withdrawn or lent PLUS money deposited.
>
> (c) Deposits equal last month's total LESS withdrawals PLUS new deposits.
>
> (Killbery (1979) p.114)

TABLE 3.1

SCORES ON THE TEST OF UNDERSTANDING OF THE PROCESS OF CREDIT CREATION

	Pre-test scores(%)	Post-test score(%)	Gain
	27	67	40
	27	47	20
	13	60	47
Control group	33[1]	87	54
	60[1]	40	-20
	20[1]	67	47
Mean score	30	61	31
	47[1]	73	26
	13	73	60
	27	47	20
Computer group	53[1]	87	34
	27	47	20
	20	60	40
Mean score	31	65	34

t statistic 0.32

1 scores of students who had studied economics at OL.

From this it is clear that any student pondering over the dynamics of the computer exercise whilst involved in the group work may have found himself falling behind and, of course, may never have fully discovered what was going on. This confusion over the processes at work led most students to conclude that their performance in economics had not been improved significantly by use of the computer.

Most students felt that the demonstration of the credit multiplier in part 2 of the program was a definite improvement over anything that could be presented in a book or by a teacher, because of the speed with which the effects of changing the cash ratio and the percentage receipts redeposited could be observed. However, in general, the point was made again that it is not possible to stop a computer and ask it questions and for this reason the conventional teacher-based method of instruction was preferred.

Comments on the use of the materials

There was little advantage to be gained from using the computer with the students involved in this case study. The difference in gain in performance measured by test scores was insignificant. It has already been stressed that it is not possible to draw any general conclusions from this, since under different circumstances and with different students, a more favourable outcome may have resulted. It might further be concluded that use of this program from cold with only the students' notes for explanation actually brought about a diminished enthusiasm for CAL amonst the students.

In terms of organisation, fitting classes around three sessions on the computer, can be difficult, leading to problems of continuity of instruction. The major problem (discussed in the previous section) stems from the many competing claims made on the computer's time in the secondary school. The problem of time becomes extremely acute if it is desired to use the computer program with very small groups in order to maximise the level of student participation. Under these circumstances even the most successful CAL materials may be overlooked in order to use the time involved to cover more of the ground of the economics syllabus.

IV. A Survey of CAL in Economics Education

The aim of this survey was to obtain information about the proportion of teachers using CAL in economics education and the extent to which the Schools Council Computers in the Economics Curriculum (1979) materials were being used in the classroom. Some attempt was also made to discover the reasons for using CAL, e.g. due to a positive effect on student performance, and the reasons for not using CAL if a computer was available. The survey was also used to discover the likelihood of computer use in the future by those teachers who had yet to become involved with CAL in economics.

A pilot survey of teachers attending a residential, in-service conference on economics education in Kent was followed by a survey of the members of the Economics Association in Kent. No attempt was made to obtain a random sample of teachers for the survey, although this would have yielded more valid results which may have been capable of generalisation. The reason for taking a quota sample of economics teachers was to keep costs to a minimum, in keeping with a small-scale project of which this survey is a part. There seems to be no reason why the questionnaire developed for this survey (see appendix 4) should not be used more widely in the future with a random sample of teachers to glean information about the national scene regarding the use of CAL in economics education.

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TABLE 4.1

COMBINED RESULTS OF THE SURVEY OF THE USE OF COMPUTERS IN ECONOMICS EDUCATION

	Eversley		Ec. Ass.		Combined	
	No.	%	No.	%	No.	%
Institution:						
Grammar	7	63.6	8	50	15	55.6
Modern	1	9.1	-	-	1	3.7
Comprehensive	3	27.3	-	-	3	11.1
Independent	-	-	6	37.5	6	22.2
F.E.	-	-	2	12.5	2	7.4
TOTAL	11	100.0	16	100.0	27	100.0
Position:						
H.O.D.	6	54.5	9	56.3	15	55.6
Assistant	5	45.5	7	43.7	12	44.4
Years' teaching (average)	5.1		10.0		8.0	
Computer available	11	100	13	81.3	24	88.9
Used	6	54.5	4	25.0	10	37.0
Not used	5	45.5	9	56.3	14	51.9
Schools Council materials used	6	54.5	2	12.5	8	29.6
Other materials used	-	-	3	18.8	3	11.1

The nature of the sample

The pilot sample consisted of 21 economics teachers attending a conference on economics education at Eversley College, Kent. Of the 21 questionnaires distributed, 13 were returned, producing a response rate of just over 60 per cent. It might be expected that teachers willing to attend a residential conference would be amongst the most enthusiastic and possibly better informed economics teachers. With one exception, none had been teaching for more than eight years, and two were new to the profession. The majority of the teachers surveyed at Eversley College taught in Grammar Schools (see Table 4.1). This is a feature of the sample which may have been avoided in a larger survey by using a stratified sample, but it is still likely that a large number of grammar school teachers would be a dominant feature of any survey based on Kent, as the maintenance of the grammar school is a feature of the education policy of the County. Indeed, at the time of writing, schools are adopting the title grammar school in the face of a national trend in recent years towards comprehensive schooling.

The survey of members of the Economics Association in Kent involved a sample of 38 members. Where members of the Economics Association had also been in attendance at the Eversley College conference, they were not contacted again. The questionnaire was sent by post together with details of forthcoming activities planned by the Kent Economics Teachers Association. A pre-paid envelope was provided for replies. In the event, 19 replies were received producing a response rate of 50 per cent, although 3 of these had to be excluded from the analysis of results for various reasons, such as no longer teaching economics.

Of the 16 replies which could be used for analysis, half came from grammar school teachers and over one-third more from teachers working in the independent sector, so that the possibility of the outcome of this survey reflecting a national picture in any sense is likely to be small. However, with this limitation in mind, and if the finding of Holley and Skelton (1980) that grammar schools are more likely than other types to provide economics courses is generally true, the results of this survey may indicate an upper limit on the use of CAL in economics education.

The Economics Association sample contained teachers of long-standing (with an average of 10 years' teaching experience) of whom over half were departmental heads. It is possible that a correlation may exist between experience and the confidence required to innovate through the use of new techniques, but it may be just as likely that 'old hands' may feel that they are responsible for a department which, in the words of one respondent, is 'going fine without it' and thus they may avoid a new approach to teaching the subject.

The Questionnaire

The questionnaire used with the Economics Association sample, and presented in appendix 4, differed from the pilot survey questionnaire in two respects. The pilot survey showed that question 5 should provide space for respondents to indicate that, although they had facilities available, they never used the computer for teaching economics, and to specify the reason(s) for this. Also, the questionnaire was condensed into two sides of one sheet of paper, in contrast with the rather unwieldy three page pilot version, to make handling, completion and posting easier.

Results of the survey

Combining the results of the pilot survey of teachers at the Eversley College conference and the survey of Economics Association members in Kent showed that most respondents taught in institutions where some kind of computer facilities were available (see Table 4.1.). However, only 10 out of the 27 teachers (37%)

TABLE 4.2

EXTENT OF COMPUTER USE IN ECONOMICS TEACHING

	Eversley		E.A.		Combined	
	No.	%	No.	%	No.	%
Extent of computer use where computer available	6	54.5	4	30.8	10	41.7
Extent of use of Schools Council materials where computer available	6	54.5	2	15.4	8	33.3

TABLE 4.3

FREQUENCY OF USE OF THE SCHOOLS COUNCIL COMPUTERS IN THE ECONOMICS CURRICULUM MATERIALS IN THE COMBINED SAMPLE

Unit	No. of teachers citing AL use	No. of teachers citing OL use
Elasticity of Demand	5	3
Price Fluctuations	5	2
Price Stablisation	4	1
Theory of the Firm	4	1
The Multiplier	5	-
Fiscal Policy	5	1
Creation of Credit	4	1
Monetary Policy	4	-
Gains from Trade	-	2

responding could claim to have used the computer for teaching economics. As a proportion of teachers having facilities available, this figure rises to almost 42 per cent of teachers (see Table 4.2). This means that over half ot the teachers who may have been able to do so were not actively using CAL in economics education.

Reasons for not using the computer included lack of time, lack of knowledge of how to use the machine and lack of finance to purchase materials. Three teachers mentioned the problem of gaining access to the computer, especially when the computer is used for other purposes such as in a Computer Studies course. Others expressed doubt about using the computer with large groups. The use of CAL with large groups was perceived as a problem by one experienced user. One teacher expressed nervousness about the unknown and yet another admitted to just not having got around to it yet.

The Schools Council Computers in the Economics Curriculum (1979) materials had been used by a total of 8 of the teachers contacted (see Table 4.1), that is to say that about one-third of teachers who have used the computer to teach economics have used these materials (see Table 4.2).

Table 4.3 shows the number of positive responses to each section of question 8, on which materials were found to be most useful. Only one teacher expressed any difficulty with using these materials, and in this case, the problem occurred with 'Monetary Policy'. Other teachers experienced general problems in using CAL due to their own inexperience and perceived lack of the technical knowledge involved in loading machines, etc. Very few teachers were prepared to commit themselves on ways in which use of the Schools Council materials might have been useful. However, the four teachers that did respond put emphasis on 'increased motivation of students towards economics' as a main gain from the use of CAL.

Of the 27 teachers responding to the questionnaire, only 2 had been involved with any group established for the purpose of developing CAL materials in economics.

Two of the teachers without a micro computer expected this situation to change in the near future, and both intended to use CAL in the economics curriculum, and one of the respondents confidently expected more computers to become available. The inclusion of these two teachers intending to use CAL increases the proportion of teachers contacted who were positively involved with CAL in economics education to around 44%, i.e. under half of the respondents.

Conclusion

The finding that less than half of the teachers contacted had used or intended to use CAL in economics may not be representative of teachers as a whole, because of the biased nature of the sample and its small size. However, the 27 teachers contacted made up of conference participants and Economics Association members, may be considered as being amongst the more active in the field by virtue of their association with these groups. If this is the case, the observation that less than half of this sample is involved with CAL suggests that this is an instructional innovation which is yet to gain widespread acceptance in the classroom.

V. Conclusions

The limitations of the case studies presented here lie in the nature of the samples which were too small to produce results capable of generalisation. However, even if it had been possible to use a more rigorous research design, it is doubtful that this would have shed much more light on the validity of this information, because the outcomes of education are rarely to be observed totally in easily quantifiable form. An improvement in average score on a test, even if that test is valid and reliable, may not by itself indicate good practice, and it is equally true that good practice may not manifest itself solely in terms of improved test results, but may be seen in a range of other ways through enhanced motivation, improved relationships between teacher and student, greater student confidence and so on. For these reasons, the case study method can provide a valuable insight into the use and impact of a new teaching method, and pave the way for further research of a more rigorous nature if it is required.

Much sophisticated psychometric research into the impact of CAL on economic understanding in the U.S.A. has generally failed to show a marked improvement resulting from the use of this method, and the case studies presented here lead to a similar conclusion that it is not clear that the use of CAL has a superior effect on learning compared with more traditional methods. The most interesting observation to emerge from these studies is that the size and composition of the teaching group in terms of the ability and motivation of the students is an important factor in computer-assisted learning. Able, confident students may dominate while less able members of the group may opt out of the learning process and find it easy to do so.

As yet, CAL is not used by a majority of secondary school economics teachers, and this may be due to diffidence about use of the machine, the lack of any perceived need to use CAL and the more practical problem of fitting the computer into the teaching schedule.

The proliferation of new CAL materials continues and the future seems certain to bring improved graphics - 'the electronic blackboard,' data-bases and more 'realistic' models for classroom use. With all this development occurring, there is a pressing need for more research into the ways in which CAL can improve the quality of economics education in the classroom and for a greater effort to be made to find out what the teacher wants his computer to do. In-service training involving economics teachers in the development, evaluation and dissemination of CAL would be preferable to the current trend towards producing CAL materials in the same way as textbooks come into being, that is at the request of publishers who perceive a potential market. The computer is a much more flexible resource than a textbook and for this reason warrants more perceptive evaluation of its uses in the classroom.

APPENDIX 1

TEST OF UNDERSTANDING OF KEYNESIAN ECONOMICS FOR A LEVEL STUDENTS

Time allowed: 35 minutes

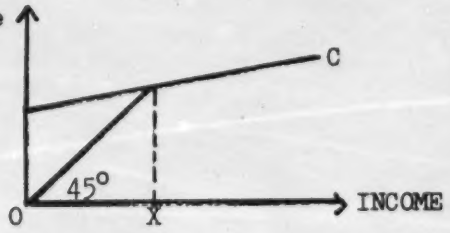
Instructions: attempt ALL questions. Indicate an answer by underlining the appropriate letter A, B, C, D, or E on the answer grid provided.

1. Question 1 is based on components of an economy given below.

   A Consumption
   B Imports
   C Investment
   D Saving
   E Taxation

   Which of the above is an injection into the circular flow of income?

2. Expenditure



   In the above diagram of the consumption function the marginal propensity to consume is

   A greater than the average propensity to consume at levels of income below OX and less than the average propensity to consume at levels of income above OX
   B greater than the average propensity to consume at all levels of income
   C constant at all levels of income
   D positive at levels of income below OX and negative at levels of income above OX
   E above 0.5 at all levels of income

3. The marginal propensity to consume measures the

   A relation between changes in consumption and changes in utility
   B relation between changes in consumption and changes in imports
   C relation between changes in consumption and changes in income
   D proportion of household incomes spent on consumer goods
   E proportion of National Income spent on consumer goods

4. What is the equilibrium level of National Income in a closed economy if private investment is constant at £300 million and government expenditure is constant at £200 million, and if planned consumption expenditure is always thre-quarters of income?

   A £500 million B £875 million C £1200 million
   D £2000 million E £2500 million

5. In a simple economic model where the marginal propensity to save is one-tenth, the marginal propensity to import is one-fifth, and the marginal propensity to tax is one-fifth, the multiplier is

A 2 B 3 C 4 D 5 E 10

6. An economy has a marginal propensity to save of 0.2, a marginal propensity to import of 0.1 and a marginal propensity to pay taxes of 0.1

Assuming that this economy has unemployed resources, the numerical value of the multiplier would be

A 2 B 2.5 C 3 D 3.5 E 4

7. Assume a closed economy with no government intervention. If the marginal propensity to save equals the marginal propensity to consume

A there will be a fully employed economy

B the value of the multiplier must be 2

C consumption will be insufficient to achieve equilibrium income

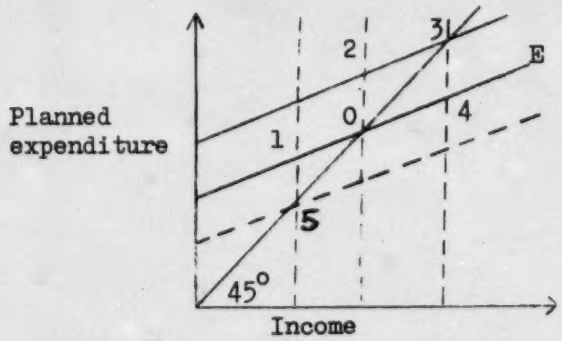
D there will be inflationary gap

E there will be a deflationary gap

8. A community's income rises by £100 million and its citizens spend £75 million more on consumer goods. The value of the multiplier in that community is

A 0.25 B 0.75 C 1 D 3 E 4

Question 9 is based on the Income-Expenditure diagram given below. The 45° line shows points at which expenditure equals income. E is the aggregate expenditure schedule and 0 indicates the initial equilibrium position.



9. What would be the new equilibrium position following an increase in exports (assuming no other changes)?

A 1 B 2 C 3 D 4 E 5

10. The marginal propensity to consume domestically produced goods in an economy is three-fifths at all levels of income. Assuming there is an increase of £100 million in exports and no other changes, then income will increase by

A £40 million

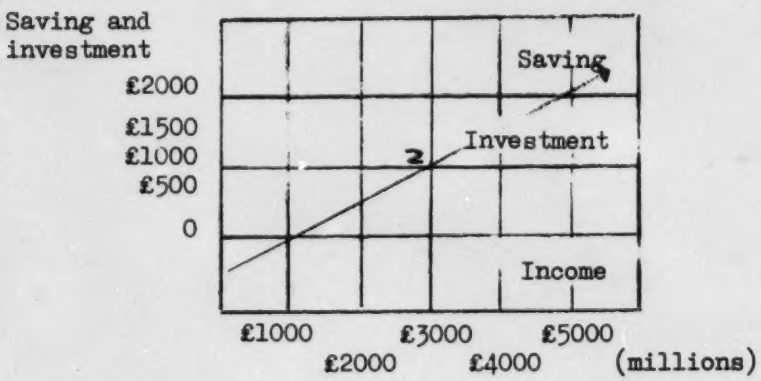
B £60 million

C £100 million

D £167 million (approx.)

E £250 million

Question 11 is based on the following diagram:



11. Assuming that the economy illustrated was at equilibrium at point Z, what would be the new equilibrium income after an increase in investment of £500 million?

A £2000 million

B £2500 million

C £3000 million

D £3500 million

E £4000 million

12. Investment in a closed economy is expected to increase by £3000 million in the coming year. The marginal propensity to save of the community is calculated as being 0.40. What will be the expected growth in the size of the National Income under these circumstances?

A £4200 million

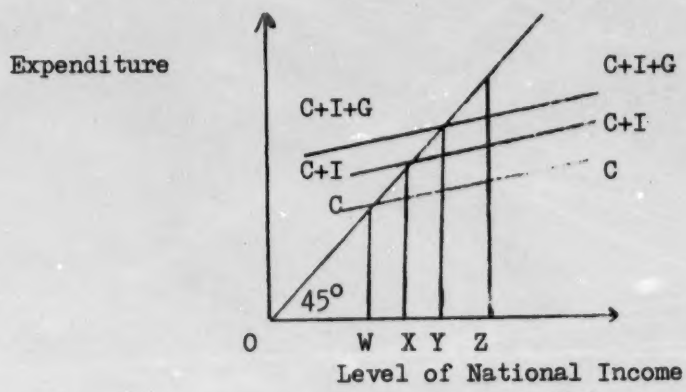
B £4800 million

C £7200 million

D £7500 million

E £7800 million

Questions 13 and 14 are based on the following diagram.



13. Assuming a closed economy, at what level of income will full equilibrium be reached?

A OW

B OX

C OY

D D OZ

E Cannot be determined

14. Assuming a closed economy, if the level of income sufficient to maintain full employment were OX, the existing equilibrium position would be one where

A a deflationary gap exists

B an inflationary gap exists

C expenditure is less than National Income

D the equilibrium and full employment positions coincide

E its relationship to full employment cannot be determined.

15. An inflationary gap will occur when

A the prices of goods rise at a faster rate than their costs of production

B the demand for goods and services increases more rapidly than their supply

C the owners of the factors of production demand higher rewards for their use in a situation of full employment

D a country in full employment has an aggregate demand greater than current output

E the world prices of commodities and raw materials rise at a faster rate than the country's retail price index.

Questions 16-18 are based on the following measures which a government might choose to adopt when faced with a budget defecit.

A A reduction of £1000m in both taxation and government expenditure

B A reduction of £1000m in government expenditure

C A reduction of £1000m in taxation

D A reduction of £1000m in taxation and an increase of £1000m in government expenditure

E An increase of £1000m in both taxation and government expenditure

Which of these measures, by itself, would

16. leave the budget unchanged, but cause a fall in aggregate money demand?

17. reduce the budget deficit?

18. cause the largest rise in aggregate money demand?

19. If aggregate demand is more than aggregate supply at the point of full employment, then the gap may be closed by

A decreasing the volume of imported goods and services

B decreasing government expenditure and taxes by equal amounts

C decreasing government expenditure and increasing borrowing

D increasing investment in the private sector

E increasing consumption in real terms

20. Which of the following measures of fiscal policy would be likely to reduce aggregate demand?

A Reduce existing charges made for drugs supplied under the National Health Service

B Increase transfer incomes without raising taxation

C Raise total government spending and taxation by equal amounts

D Reduce indirect taxes and raise direct taxes on higher income levels to maintain the same revenue

E Reduce unemployment benefits without lowering National Insurance contributions.

To answer questions 21 and 22 write:

A if all statements are correct,

B if statements 1 and 2 only are correct,

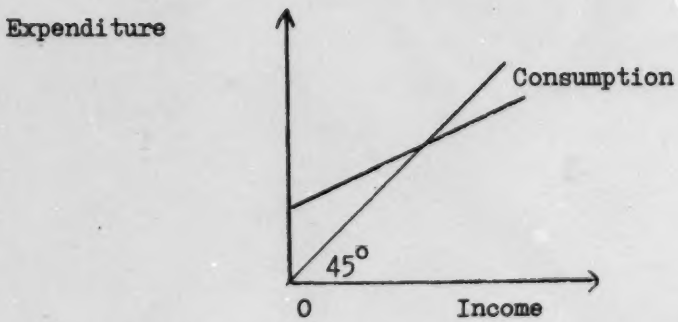
C if statements 2 and 3 only are correct,

D if statement 1 only is correct,

E if statement 3 only is correct

Directions Summarized				
A	B	C	D	E
1,2,3 correct	1,2 only	2,3 only	1 only	3 only

21.



The above diagram illustrates a consumption function in which the

1 marginal propensity to consume is constant

2 average propensity to consume is declining

3 rise in consumption is proportionally less than the rise in income

22. In an under-employed economy, an increase in employment would be likely to follow from

    1 a decrease in government current expenditure

    2 an increase in demand for imports

    3 an increase in fixed capital formation

APPENDIX 2

Test of Understanding of the Process of Credit Creation

Sources

1. Stanlake, G.F., Objective Tests in Economics, Longman 1979, Chapter 8, Qu. 194, 195, 197

2. Anthony, V., Objective Tests in Introductory Economics, HEB, 1978, Chapter 13, Qu 3

3. Powicke, J.C., and Turner, A., Multiple Choice Questions for Economics, Arnold, 1973 Chapter 6, Qu 21

4. Anthony, V., and Baron, D., Objective Tests in AL Economics, HEB 1972 Chapter 7(I), Qu 17, 19; 7(II) Qu. 5,6

5. Watts, M. and Glew, M., Topics and Objective Test Questions in AL Economics HEB, 1975

6. Livesey, F., Objective Test in AL Economics, Hodder and Stoughton, 1979 Test 12, Qu 11, 12

7. Chapman, J. and Smith, J.C., Multiple Choice Questions in Economics, HEB 1974 Chapter 8, Qu 16, 17

TEST OF UNDERSTANDING OF THE PROCESS OF CREDIT CREATION FOR A LEVEL STUDENTS

Answer all questions by underlining the appropriate letter on the answer grid provided

Time allowed: 21 minutes

1. The total amount of money in a country consists of:

(a) Coins (b) Bills (c) Gold (d) Coins and Notes
(d) Bank Deposits

(i) a and b only (ii) a, b and c only (iii) c, d and e only
(iv) d and e only (v) e only

2. The Commercial Banks need cash in order to:

(i) Meet the cash requirements of ...
(ii) Settle its debts with ...

Which of the words below fit the gaps best?

(a) Share-holders (b) Customers (c) Other banks
(d) Government (e) Treasury

3. When a bank makes a loan to an existing account holder

1 its assets increase by the amount of the loan
2 its liabilities increase by the amount of the loan
3 other things remaining equal, the money supply increases

A 1, 2 and 3
B 1 and 2 only
C 2 and 3 only
D 1 only
E 3 only

4. The process of credit creation has the effect of:

(a) Increasing the real wealth of the community
(b) Raising the real National Income
(c) Increasing the power of the pound in relation to other currencies
(d) Increasing the supply of money
(e) Decreasing the number of outstanding debts

5. The Commercial banks can create money by:

(a) Printing more notes
(b) Attracting more customers
(c) Selling Treasury bills
(d) Opening up deposits for borrowers
(e) Buying bonds from the Bank of England

6. Which of the following items appear on the assets side of a bank's balance sheet?

(i) Current accounts
(ii) Deposit accounts
(iii) Deposits by overseas residents
(iv) Balances with other U.K. banks
(v) Bills discounted

(a) all of them
(b) i, ii and iii
(c) iv and v
(d) all but iii

7. Which of the following will NOT appear on the liabilities side of a bank's balance sheet?

A Deposits held on current account
B Time deposits
C The share capital of the bank
D Loans to customers

8. A bank creates bank deposits when it:

I grants a customer an overdraft
II buys securities from the public
III buys securities from the Bank of England
IV aids to its reserves with the Bank of England

(a) I only
(b) I and II
(c) I, II and IV
(d) I, III and IV

9. By which of these actions do English Joint Stock banks normally increase bank money?

1 granting overdrafts to customers
2 buying securities on the Stock Exchange
3 issuing more notes
4 increasing special deposits with the Bank of England

A 1 and 2 only B 1 and 3 only C 2 and 4 only
D 3 and 4 only E all of them

10. Three of the following restrict the creation of credit by commercial banks. Which does not?

(a) The amount of collateral available
(b) The customers' demand for credit
(c) The note issue
(d) The Bank of England

11. The banks, in a multi-bank system, maintain a minimum cash ratio of 10%. An individual bank receives a cash deposit of £1,000. On the basis of this additional cash this particular bank will feel able to create additional deposits equal to

A £10,000
B £9,000
C £1,100
D £1,000
E £900

12. A bank which maintains a 10% cash ratio has total deposits of £1,000. In order to maintain this ratio following a fall of one half in its cash holding, it will have to reduce its other assets by

A £50
B £100
C £400
D £450
E £500

13. A banking system comprises five banks each of which maintains a minimum cash ratio of 10 per cent. If each of the banks received additional cash deposits of £100, the system could create further deposits up to a maximum of

A £450
B £500
C £1000
D £4500
E £5000

14. If all the commercial banks in the economy operated on a 10 per cent reserve ratio and customers wanted all the money they could possibly borrow, what would be the effect of a £2000 cash deposit on the money supply.

A It would increase by £20,000
B It would increase by £2,000
C It would increase by £18,000
D It would increase by £1,800
E It would not increase at all.

APPENDIX 3

Sample output of Part 1 of Creation of Credit

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SCHOOLS COUNCIL PROJECT
COMPUTERS IN THE CURRICULUM

CREDIT CREATION - CREDIT   VER 14

WHICH PART:   1.  GOLDSMITH
              2.  MULTIPLIER DEMO
              3.  JOINT-STOCK BANK   ? 1

TYPE AN INTEGER 1 TO 40? 20

100 IS DEPOSITED WITH YOU,
THE ONLY GOLDSMITH IN THE AREA
YOUR AIM IS TO MAXIMISE INCOME FROM
LOANS AT 5%

BALANCE SHEET AT END OF MONTH     0
GOLD       100      DEPS       100
LOANS        0
CASH RATIO          100%

MONTH 1
DISEASE KILLS LOCAL CATTLE
BORROWERS REPAY      0
NEW LOANS?  90

MONTHS BUSINESS
PAID IN:    163
W'DRAWN:     97

BALANCE SHEET AT END OF MONTH   1
GOLD        76       DEPS        166
LOANS       90
CASH RATIO       45%

MONTH        2
FARMERS SPEND ON FIELD DRAINAGE
BORROWERS REPAY   8

NEW LOANS? 50

MONTHS BUSINESS
PAID IN:  155
W'DRAWN:  127

BALANCE SHEET AT END OF MONTH   2
GOLD        62      DEPS          194
LOANS      132
CASH RATIO          31%
```

```
MONTH 3
FARMERS SPEND ON FIELD DRAINAGE
BORROWERS REPAY    11
NEW LOANS?         55

MONTHS BUSINESS
PAID IN:          185
W'DRAWN:          157

BALANCE SHEET AT END OF MONTH  3
GOLD     46            DEPS      222
LOANS   176
CASH RATIO         20%

MONTH 4
CHEAP COAL BOOSTS NAILERS INCOMES
BORROWERS REPAY    15
NEW LOANS?         45

MONTHS BUSINESS
PAID IN:          160
W'DRAWN:          176

BALANCE SHEET AT END OF MONTH  4
GOLD      0            DEPS      206
CASH RATIO          0%

DEPOSITORS ARE WAITING TO WITHDRAW
A FURTHER          43
WORD SPREADS THAT YOU CANNOT PAY THEM

MONTH 5
RUN ON YOUR BANK
BORROWERS REPAY    18
NEW LOANS?          0

MONTHS BUSINESS
PAID IN:            0
W'DRAWN:           18

BALANCE SHEET AT END OF MONTH  5
GOLD      0            DEPS      188
LOANS   188
CASH RATIO          0%

PANIC - DEPOSITORS RUSH TO WITHDRAW
THEIR MONEY, YOU STILL OWE THEM 188

MONTH 6
RUN ON YOUR BANK
BORROWERS REPAY    16
NEW LOANS?          0

MONTHS BUSINESS
PAID IN:            0
W'DRAWN:           16
```

```
 BALANCE  SHEET  AT  END  OF  MONTH     6
GOLD            0           DEPS        172
LOANS         172
CASH  RATIO                 0%

YOUR  BANK  IS  RUINED.   NO-ONE  HAS
CONFIDENCE  IN  IT.   REPAY  REMAINING
DEPOSITORS  WHEN  LOANS  REPAID.

AVE.  INCOME  FROM  LENDING  OUT  CUSTOMERS
DEPS                .57  PER  MONTH
```

APPENDIX 4

QUESTIONNAIRE ON THE USE OF COMPUTERS IN ECONOMICS TEACHING

This questionnaire is intended to generate information about the extent and nature of the use of computer assisted instruction in economics in schools. In particular, some questions concentrate on the use of the Schools Council Computers in the Economics Curriculum materials published by Longmans. The questionnaire is in two parts, inviting a response from those who have computer facilities and those who have not.

All information given will be treated in the strictest confidence

No use will be made of replies which could result in the identification of any individual or establishment

1. What type of establishment do you teach in? .....
   (e.g. Comp., Grammar, Modern, FE)

2. What is your post? .....
   (e.g. Economics teacher, H.O.D.)

3. Number of years' teaching economics? .....

IF YOU HAVE COMPUTER FACILITIES IN SCHOOL

4. What type of facilities are available? .....
   (e.g. RML 380Z)

5. Do you use the computer for instruction in economics at:

   A LEVEL

   O LEVEL

   CSE

   OTHER

   NEVER USED (please specify reason) .....

6. Do you use any of the Schools Council Computers in the Economics Curriculum materials?

   NO

   YES

7. Do you use any other computer materials? (please specify)

   .....

   .....

   .....

8. Which, if any, of the Schools Council Computers in the Economics Curriculum materials have you found most useful, and in which courses?

	A level	O level	CSE	Other
Elasticity of Demand				
Price Fluctuations				
Price Stablisation				
Theory of the Firm				
The Multiplier				
Fiscal Policy				
Creation of Credit				
Monetary Policy				
Gains from Trade				

9. In what ways, if any, have the Schools Council Computers in the Economics Curriculum materials been useful?

a improved performance of students in economics
b increased motivation of students towards economics
c enhanced the students' opinion of you as a teacher
d other (please specify) _____

_____

10. Have you experienced any difficulties with the use of computer assisted instruction in economics?

NO

YES (please specify materials) _____

_____

11. Have you been involved with any of the groups established to develop materials for computer assisted instruction in economics?

NO

YES (please specify) _____

_____

IF YOU DO NOT HAVE ACCESS TO COMPUTER FACILITIES IN SCHOOL

12. Do you expect computer facilities to become available in the near future?

NO

YES

13. If computer facilities become available, will you consider using materials for computer assisted instruction in economics?

NO

YES

14. Do you foresee any problems arising from the use of the computer for instruction in economics?

NO

YES (please specify) _____

_____

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